Development of an Earth Smallsat Flight Test to Demonstrate Viability of Mars Aerocapture

Completed Technology Project (2016 - 2020)

Project Introduction

Aerocapture is an orbit insertion technique that offers significant reductions in mass and cost for a large number of space missions. Despite its benefits, one of the main reasons that aerocapture has not been used on a flight mission is that it has not yet been flight tested. The research proposed here will address this problem by designing an Earth-based aerocapture flight test utilizing a smallsat. Conceptual design of the flight test will focus on producing a fully-documented mission concept to demonstrate aerocapture. One of the primary conceptual challenges involves developing an aerocapture flight system for use on a smallsat. Techniques such as drag modulation-based energy control will be considered to reduce the system complexity. System selection will be accomplished through means of a comprehensive trade study; focus will be placed on control and thermal requirements, simplicity, and the applicability of the system to other missions. The chosen system will drive other facets of mission design, such as the guidance method utilized by the smallsat and selection of the mission trajectory. The second phase of this research will focus on physically developing and testing the aerocapture system and spacecraft in preparation for the smallsat test flight. A secondary payload mission architecture will be utilized for the flight test to minimize cost. The design process of the spacecraft will offer a number of opportunities for student leadership and multidisciplinary collaboration. A successful demonstration will show that aerocapture can be used as an effective means of orbit insertion at Mars and other atmospheric worlds, with scalable applications to both large and small spacecraft and missions.

Anticipated Benefits

A successful demonstration will show that aerocapture can be used as an effective means of orbit insertion at Mars and other atmospheric worlds, with scalable applications to both large and small spacecraft and missions.

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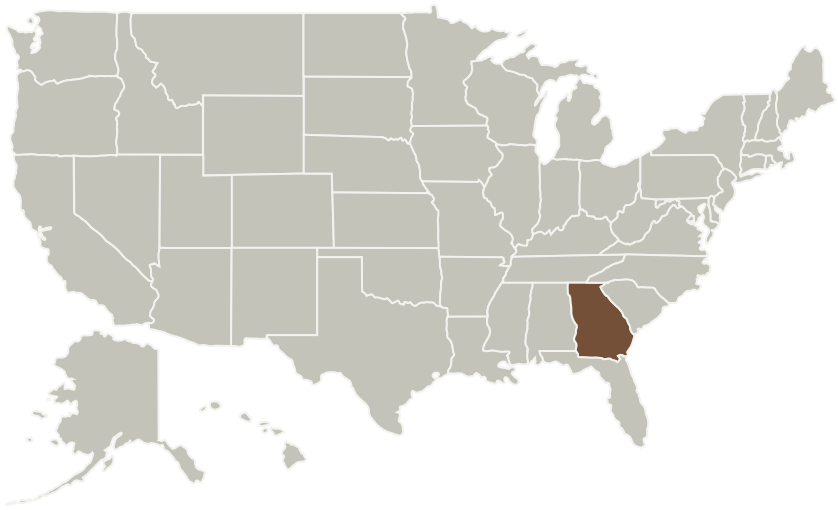
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Georgia Institute of Technology-Main Campus(GA Tech)	Lead Organization	Academia	Atlanta, Georgia

Primary U.S. Work Locations
Georgia

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Georgia Institute of Technology-Main Campus (GA Tech)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Robert D Braun

Co-Investigator:

Michael W Werner

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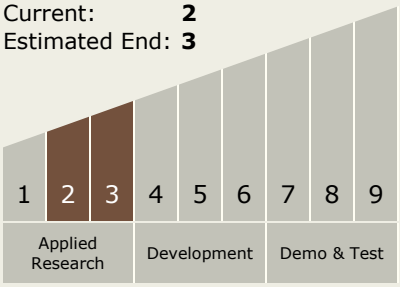
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
  - TX09.1 Aeroassist and Atmospheric Entry
    - TX09.1.2 Hypersonic Decelerators

Target Destination

Mars